JELLIFFE (S.E.)

Some Laboratory Moulds.

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ON SOME LABORATORY MOULDS.

By Smith Ely Jelliffe, A.B., M.D.

Workers in bacterial laboratories are liable to have their plates contaminated by other growths than bacteria and it has been deemed advisable to isolate and cultivate the more common moulds and yeasts, study their characters, determine them and prepare a key which will afford a ready means, in the hands of those interested, for the classification and naming of these organisms.

Bacteriological manuals give little information about the large class of moulds which form a great part of the contaminating growths, and the non-botanically trained bacteriologist finds himself in a hopeless confusion the moment an endeavor is made to hunt up the systematic literature of the group.

Most of the forms found belong to the great fungus class, the Hyphomycetes. This group is at best a motley one, and in systematic botanical writings goes under the general name of the "Fungi imperfectae," as many of the forms, which in times past were considered autonomous, are now known to be but life stages in the development of higher fungal forms, notably of the Ascomycetes, or Sac Fungi. This incompleteness renders the study of these forms somewhat difficult, and when taken in conjunction with the elementary nature of the organisms, which has led to endless naming of forms very inadequately described, complicates the study to a marked degree; so much so that it is at the present time impossible to know what were the organisms described by many earlier writers, especially when a few Latin phrases were considered sufficient to designate the forms seen. While this difficulty is in part lessened by the study of authentic specimens, the fact still remains that many of these forms cannot be determined with certainty.

*Contribution from the Bacterial Laboratory of the College of Physicians and Surgeons, Columbia University, New York.

(1) *It is a pleasure to extend thanks to Professor Prudden and Drs. Cheesman and Dyar for their help during the progress of this work.*

The facility for the study of these growths is exceptional in the laboratories of the College of Physicians and Surgeons on account of the extended and elaborate undergraduate course of instruction in bacteriology.

Two or three times a week the medical students in the practical bacteriological course, expose for a varying length of time anywhere from 50–100 plates, and as this continues throughout the year the number of air exposed plates is in the aggregate an enormous one. These plates were placed at my disposal and the forms found have been cultivated.

The methods of cultivation employed were similar in general principles to the ordinary bacterial technique. Some minor modifications were introduced as the study progressed, determined by special circumstances. For the most part pure cultures of the moulds could be obtained by direct transplanting from the plate growths to the seed tubes; the necessity for plating and subsequent isolation being rarely required. The isolation of the yeasts of course formed an exception to the general practice.

A large number of media were tried, but, on the whole, nutrient gelatine, 1¼% nutrient agar, nutrient glycerine agar and potato agar were used. These different media are too familiar to require details. Glycerine agar proved to be the most favorable medium for the majority of the moulds found.

For the purposes of study the pure cultures were taken from the seed tubes and plated upon petri dishes in gelatine, the transparency of this medium making it especially valuable. Most of the details of growth and fructification could be studied directly with a Zeiss D objective, ocular ¾ inch.

Permanent preparations may be made by taking a small amount of the mould and transferring it to a glass slide, allowing a drop or two of alcohol to fall upon it, to get rid of the air generally found in the hyphae; this may then be treated with a few drops of water, stained with any stain, preferably Methylene Blue, and mounted in glycerin, or glycerin jelly, or after dehydration in Balsam, which latter is not very satisfactory.

The classes of organisms which are in the air and which are capable of growing upon the ordinary media may appropriately be classed under three general heads; Bacteria, Yeasts and Moulds.

I. The Bacteria may be defined as minute one celled plants, destitute of chlorophyll, which reproduce by repeated equal division and occasionally form spores at the ends or in the bodies of the organism.

II. The Yeasts we define as minute one celled plants, destitute of chlorophyll, which reproduce by the method of budding. Under special conditions they also form spores which are born in sacs.

III. Moulds : This term is a popular rather than a technical word, and differs from the former two in that it possesses no definite meaning, hence to define the Moulds as a class is impossible.

The plants that go under this name present a great variety of forms and shapes and sizes. In general it may be stated that they all develop a short tubular growth from a spore which by further extension, division or ramification becomes the *mycelium* of the fungus. This mycelium may be very scanty, or it may form a thick felt-like growth ; it may consist of a single branched or unbranched cell, or it may consist of a great number of cells, which cells are generally termed the *hyphæ*.

This mycelium is analagous to the root in the higher forms of plant life and draws nourishment from the medium in which it happens to be placed. In addition to this, the vegetative part of the fungus, most moulds develop a reproductive portion which may remain within the medium or rise erect into the air ; such aerial branches are generally termed *aerial hyphæ*.

The reproductive hyphæ, whether prostrate or erect, bear reproductive cells, varying widely in their number, shape, size and arrangement; being single, in pairs, in clusters, in heads or in chains, etc.; these reproductive cells are generally termed either *spores* or *conidia*. By some writers the term spore is retained for those reproductive cells arising as a result of some form of known or unknown sexual process, while the term conidia is restricted to those cells arising by non-sexual cell division. By others the terms are used interchangeably. A fertile branch bearing spores is termed the sporangium, while one bearing conidia is termed a conidiophore.

The classification of the moulds is constantly changing, as new discoveries are being made in their methods of reproduction : thus the genus Penicillium was for a time placed with the Hyphomycetes because conidia alone were known, but the subsequent discovery of spores, borne in sacs, imbedded in the mycelium felt removes them from this class to the class of sac bearing fungi.

These facts are of primary importance to the systematic botanist, but are overlooked in the description of the forms here given, as specially devised methods are generally necessary to show these sacs. This would be of no service for the work in hand.

In one large group of the moulds, spores are formed by the conjugation of two mycelium threads; these spores are known as Zygospores. They are formed under peculiar circumstances only and rarely met with on plates.

KEY.

For the purpose of the present study two groups are to be distinguished.

(1) Mycelium growth absent ---------- YEASTS.
(2) Mycelium growth apparent ---------- MOULDS.

1 YEASTS.

2 MOULDS.

A. Mycelium abundant, richly branching. Spores (conidia) borne inside of spherical sporangia, on erect or reclining branches ---------- PHYCOMYCETES

B. Mycelium richly branching, spores (conidia) free, borne on the ends of modified hyphæ or at the sides of the hyphæ ---------- HYPHOMYCETES.

Of the Phycomycetes, representatives of one family only (Mucorini) were found. Three genera were obtained.

I. Mycelium of one kind only.

A. Spore bearing bodies borne upon straight erect unbranched branches, their membranes, for the most part soon disappearing ---------- MUCOR.

B. Spore bearing bodies borne on branched hyphæ, generally nodding, the brauch ending in a sterile point ---------- CIRCINELLA.

II. Mycelium of two kinds: (*a*) The usual finely divided mycelium, (*b*) a short stout root like series of mycelium tubes at the base of the fertile branches ---------- RHIZOPUS.

For the Hyphomycetes I follow Saccardo in his grouping. This system while it may be considered defective from a rigidly systematic point of view, is convenient, and since the group is so heterogeneous convenience is perhaps the best guide.

(1) Hyphæ pallid or slightly colored, loose, collapsing and crowded but not collected into fascicles or strands; conidia of the same color ---------- MUCEDINEÆ.

(2) Hyphæ brownish or black, crowded, more or less rigid, rarely pale, conidia dark, hyphae not collected into stem-like bundles ---------- DEMATIEÆ.

(3) Hyphæ pallid or dark, collected in dense elongated stem-like bundles ---------- STILBEAE.

(4) Hyphæ pallid or reddish, collected in wart-like masses or densely conglomerated, forming a compact stroma ---- ----------TUBERCULARIEAE.

MUCEDINEAE.

(I.) Conidia hyaline or slightly colored, spheroidal or short cylindrical, *undivided.*

I. Hyphæ short, somewhat resembling the conidia.

(1) Conidia in chains.

(*A*) Saprophytic, hyphæ short, globose or sub-oblong, not branched, conidia spherical or nearly so ---------- ---------- OOSPORA.

(*B*) Hyphæ elongated, distinctly branched, conidia small, slightly oval----------MONILIA.

II. Hyphæ elongated, differing distinctly from the conidia.

(1) Conidia aggregated on heads in chains.

(*A*) Fertile hyphæ enlarged at the apex.

X Conidia borne on simple sterigmata---------- ---------- ASPERGILLUS.

XX. Conidia on compound sterigmata ---------- ----------STERIGMATOCYSTIS.

(*B*) Fertile hyphæ not enlarged at apex.

X Conidia borne on branched hyphæ---------- ---------- PENICILLIUM.

(2) Conidia borne here and there upon simple or branched hyphæ not verti-cellate. Borne upon the ends of inflated branches, loosely aggregated------BOTRYTIS.

(II.) Conidia oval or oblong or short fusiform, once *septate*, hyaline or slightly colored.

Fertile hyphæ are simple, elongated, non-nodose, bearing a number of conidia at their apices-CEPHALOTHECIUM.

DEMATIEÆ.

I. Conidia globose, ovoid or oblong, blackish or sub-hyaline, non-septate.

A. Hyphæ short or only slightly different from the conidia. Conidia in short or long chains of a single kind, either globose or ovoid ----------TORULA.

B. Hyphæ manifest and distinct from conidia. Conidia dark, rarely subhyaline. Hyphæ from tree like branches bearing oval conidia in short chains. ------ HORMODENDRON.

II. Conidia globose to sac shaped or oblong, transversely and longitudinally septate, dark.

A. Hyphæ distinct, conidia in short chains----ALTERNARIA.

B. Hyphæ distinct, conidia single, at the ends of fertile branches ---------- MACROSPORIUM.

TUBERCULARIEÆ.

Conidia elongated, fusoid or falciform, twice or many times septate ---------- FUSARIUM.

YEASTS, SACCHAROMYCETACEÆ.

Saccharomyces:

The yeasts devolop as single cells or sometimes they form, by growing in chains, a pseudomycelium. The reproduction is typically by means of *buds* on the sides or upon the ends of the mother cell. The single cells vary from spherical to elongated elliptical, with a colorless membrane; sometimes brownish and with contents varying in color; in many of the cells characteristic vacuoles are found.

When growing in colonies they develop in various ways, generally symmetrical, but occasionally the colonies are irregular in outline; in color they are either white, ochraceous, brown, black, or various shades of red.

The species are difficult to differentiate, the individuals varying widely, according to the particular nutrient medium. Further there are a number of the higher fungi whose spores develop in a yeast like manner in certain media, and continue to do so for a considerable time.

The formation of spores has not been observed in the species under study.

I. Growth, white to dirty white.

Saccharomyces Cerevisiae Meyen.

Cells spherical or egg-shaped, 8-12 x 8-10 μ. broad; membrane colorless, contents of cells colorless; cells single or growing in short tree like branching filaments.

Saccharomyces albicans Robin.

Colonies milk white, rounded, irregular with extended margins; cells spherical about 4 μ. at times elliptical, egg shaped or cylindical, 3.5-5 μ. or sometimes long drawn out: especially when growing in fluid media: 10 times as long as broad; then the cells form a pseudo mycelium.

II. Growth reddish.

Saccharomyces glutinis Fres.

Colonies circular, rose red with smooth edges, slimy, not fluidifying gelatine.

Cells spherical or short elliptical, 5—6 μ long, 4-5 μ broad, single, in twos, or forming a false mycelium.

Does not ferment glucose.

This form is often called "Rosa hefa," but it is still a question what the Rosa hefa is.

III. Growth brownish to black.

Saccharomyces niger Marpmann,

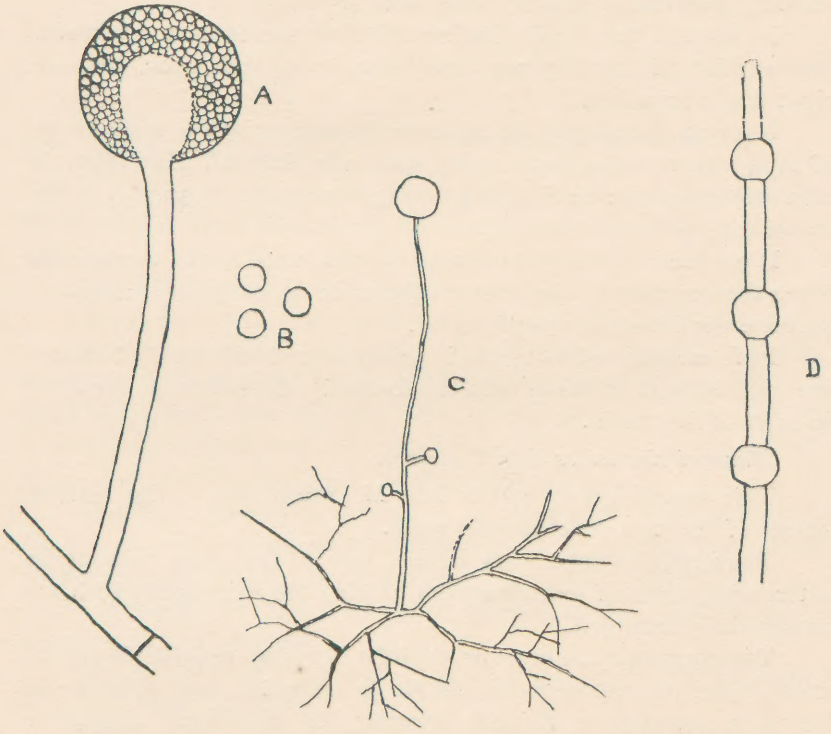
Builds circular, regular, non-fluidifying colonies upon gelatine: on agar, brownish to olive brown raised colonies darker in center, lighter on the edges.

Cells from agar plates, various in shape and size, mainly spherical, to many angled, about 5 μ in diameter.

PHYCOMYCETES.

Mycelium saprophytic or parasitic, richly branched when young consisting of a single cell, later a number of irregular cross walls appear in the mycelium.

Non-sexual reproduction taking place by means of conidia or by spores which are borne in simple or branched sporangia. Zygospores form upon the mycelium or upon special branches.



Mucor racemosus. A, Spore bearing head. B, Spores. C, Branch. D, Resting spores.

Mucor : Micheli.

Mycelium borne in or upon the medium, without any root like processes, forming a thick felt, sporangia varying, single or numerous, erect, branched or unbranched, racemose or cymose. Sporangial walls apt to dissolve and soon disappear, sometimes splitting or remaining about the base of the enlarged end of the fertile branch (the columella) disengaging the spherical or elliptical spores.

Mucor racemosus Fres.

This is is a very rapidly growing mould, perhaps the most rapid of any of the forms observed, filling a petri dish in 48-72 hours with a tawny white growth which later becomes tawny brown.

Sporangia numerous, very variable in size, 20—70 μ, single, on the ends of long branches, with a few small and secondary sporangia on the sides of the main fruiting branch.

Cell wall of the sporangium smooth or finely granular not disappearing for some time after ripening of the spores. Spores, smooth, spherical or slightly oval, from 4.5-8 μ.

In most of the media this mould forms spores on the threads, the so-called chlamydospores, these may even form upon the upright fertile branches.

It grows abundantly in most media and enjoys a wide range of temperature being found upon specimens in Prof. Huntington's cold storage room : 20 F. and growing abundantly at 37.5 C. in the incubator.

It produces no marked changes in milk until about two weeks, when the reaction is alkaline and the milk is coagulated : neither peptone nor albumose are produced.

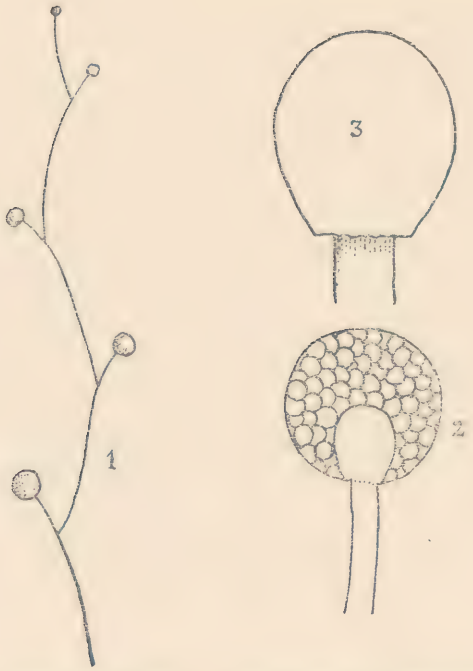
In fermentation broth, gas is produced with alcohol. Nitrates are reduced, and traces of indol are formed. Ammonia is developed in most of the media.

Mucor circinelloides Van Tieghem,

This mould grows much like M. racemosus. The earlier stages of the two are especially alike.

The fertile branches vary widely, but in the main present an alternating series of short branches bearing the sporangia which are sympodially arranged.

The sporangia are erect or slightly nodding, grayish brown in color, spherical, the membrane is finely granular, and persists ; in the first sporangium formed, however, the membrane disappears early. The columella is short globular ; the spores spherical to rounded elliptical, 3—5 μ. It forms chlamydospores and yeast-like



Mucor circinelloides. 1, Fertile branch. 2, Sporangium. 3, Columella.

chains, similar in many respects to M. racemosus. Glucose solutions undergo fermentation but saccharose does not seem to be affected.

Mucor spinosus Van Tieghem.

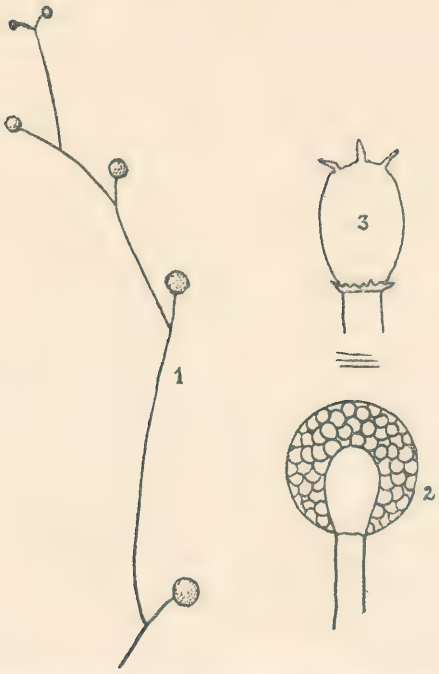
When well developed, dark rusty brown.

Mycelium richly branched and growing rapidly. Fertile branches upright about 1 cm. in height, bearing branches which generally spring from one side, only giving the erect fertile branch a wand like appearance. It bears from 3-6 sporangia generally sympodial, sometimes mixed racemose and cymose.

Sporangia spherical, 81-108 μ in diameter, with smooth or slightly granular walls which disappear early, leaving the brown spores upon the brownish columella. Columella, cylindrical, 25—60 μ and bearing at the apex a single large or several smaller tubercles or irregular projections.

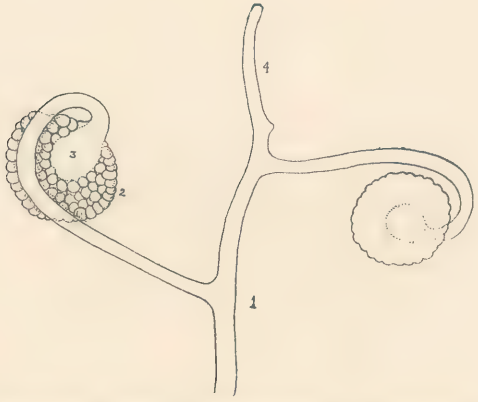
Spores irregular, from spherical to ovoid, 5-10 μ in diameter, smooth brownish walls.

This species also forms chlamydospores, it will not invert sugar, and produces in glucose only a slight fermentation.



Mucor spinosus. 1, Fertile branch. 2, Sporangium. 3, Columella.

The plant is to be distinguished from the M. circinelloides by its large spores, the soon disappearing sporangial walls, its spiny columella, and its one-sided branched fertile branches.



Circinella spinosa, 1, Fertile branch. 2, Sporangium 3, Columella. 4 Sterile tip.

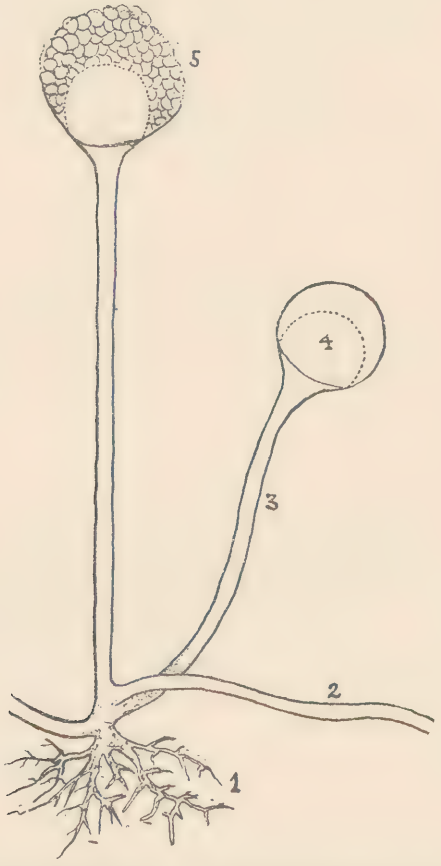
CIRCINELLA Van Tieghem.

Mycelium richly branched, growing in all directions, in the beginning one celled, later with few irregular cross walls. Sporangia borne singly, arising from the fertile hyphæ, which are sympodially branched, the branches generally ending in a sterile point.

Circinella spinosa Van Tieghem and Lemonnies.

Sporangia borne on erect or oblique branches, quite numerous, 2 mm. high, in alternating rows, the branches bearing the sporangia, being rolled inwards, the sterile branch being short, upright and ending like a sharp awn. Sporangia about 60 μ. in diameter, brownish, finely granular, the wall remaining or splitting at the equator, when the spores are shed, Columella small, cylindrical. Spores spherical, 4 μ in diameter, smooth.

The fruiting branches vary widely in this form; under its many aspects it is a very handsome form. It occurs but rarely in the laboratory.



Rhizopus nigricans. 1, Root like mycelium. 2, Runner. 3, Fertile branch. 4, Columella. 5. Sporangia with escaping spores.

RHIZOPUS, EHRENBERG.

Mycelium of two kinds, the one arising from the spore, similar to the ordinary mycelium, the other, larger, coarser, growing from the mycelium like a series of branching brownish roots and giving rise to the clustered sporangia and a series of thread-like runners.

Rhizopus nigricans Ehrenberg

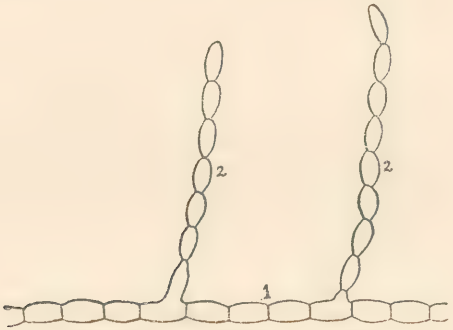
Sporangia clusterred in threes or fives, occasionally single, large, 100-350 μ. At first white, later black, columella large, broadly semi-globular. Spores, irregular rounded or broadly oval, compressed and generally flattened on one or two sides, 6-17 μ in diameter, smooth with colorless contents.

This is a very rapidly growing mould and can be detected by a hand lens by reason of the root-like branches and large sporangia. It was found to be common in the laboratory after the middle of April.

HYPHOMYECTES.

(1) MUCEDINEÆ,

OOSPORA, Wallr.



Ospora, sp. 1, Hyphæ, 2, Conidia.

Caespitose, effused or in small raised masses, loose or compact. The hyphæ are short, resembling the conidia somewhat. Conidia in chains, spherical or ovoid, hyaline or slightly colored.

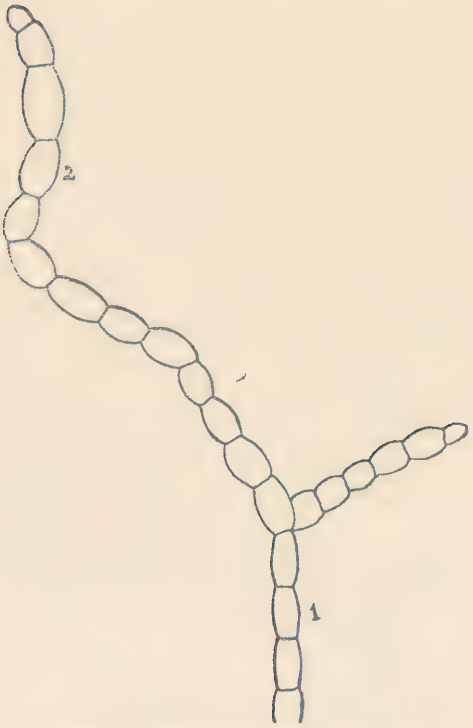
Saccardo collates the descriptions of some 79 so-called species; at least 15 species have been described from the United States.

MONILIA Pers.

Hyphæ erect, branching, densely caespitose, rarely effused, in chains.

Monilia candida Bon.

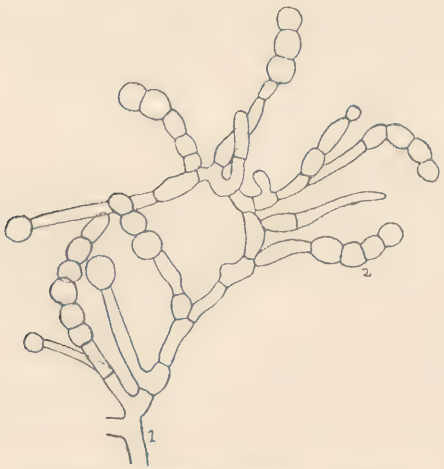
Caespitose, wooly, white, hyphæ septate, conidia in chains oval to sub-spherical, or slightly ovoid; 5x6.7 μ hyaline.



Monilia conidia. 1, Hyphæ. 2, Conidia.

Monilia racemosa Pers.

Hyphæ rising in white masses, much branched, racemose; conidia borne at the ends or at the sides in chains, globose, varying from 5-7 μ in diameter.

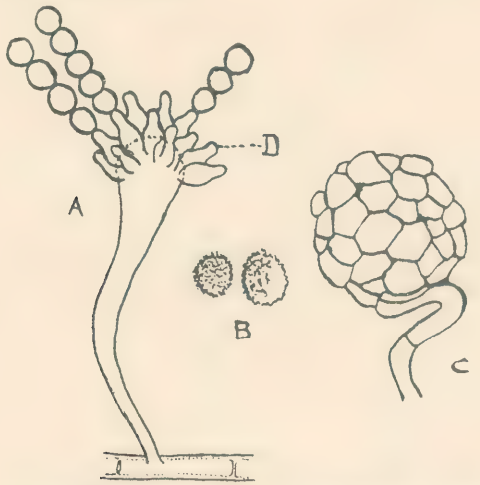


Monilia racemosa. 1, Hyphae. 2, Conidia.

ASPERGILLUS Micheli.

Mycelium richly branched, bearing numerous fertile branches which are unseptate and swollen at the apices (columella) upon which are borne simple flask shaped sterigmata, with chains of spherical or elliptical conidia. Often small yellowish to reddish bodies (perithecia or sclerotia) are found upon the sterile hyphæ at the base of the fertile branches.

Aspergillus repens DeBary.



Aspergillus repens. A, Conidia bearing head. B, Conidia. C, Perithecia. D, Sterigmata.

Mycelium richly developed, at first white, later grayish to greenish gray, later greenish to brownish green to tawny brown. Sclerotia small, yellow; fertile hyphæ erect, 2–4 mm. high, 10 μ diameter; head of conidia large, 100 μ in diameter, columella 12-30 μ, conidia slightly elliptical, minutely roughened, 5 μ, gray green to greenish brown.

Aspergillus herbariorum Wiggers.—A. glaucus De Bary.

Mycelium very richly developed, snow white at first, later light grayish green later greenish, especially towards the center, by reason of development of conidia the periphery remaining snow white. Sclerotia sulphur yellow, at first appearing in the center of the mass of mycelium, 75-95 μ in diameter. Spores in sclerotia 8-10 μ. broad, 5-7 μ thick.

Conidia borne on an undivided club-shaped columella, which is 20 40 μ broad. The long chains of conidia making a large head. Conidia spherical or elliptical 9-15 μ, membrane finely granular, brownish; conidial head, gray green to olive green.

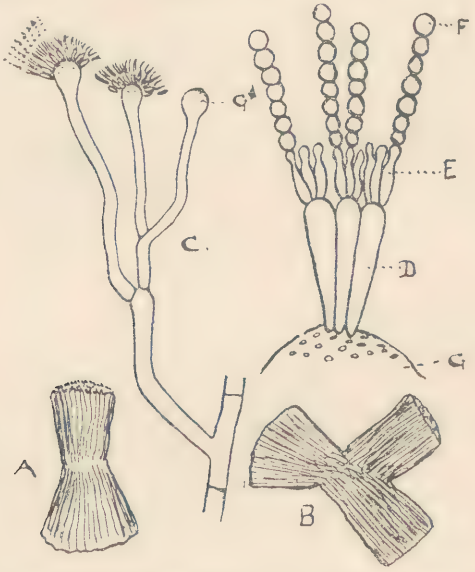
STERIGMATOCYSTIS, Kramer.

Plant throughout similar to Aspergillus, differing in the method of bearing the conidia. In this genus there is borne upon the columella a single series of elongated wedge-shaped sterigmata, upon these there is a second series of short flask-shaped secondary sterigmata ; upon these the chains ot conidia are borne.

Sterigmatocystis nigra Van Tieghem. Aspergillus nigra, De Bary.

Mycelium at first snow white, growing close, later brownish to blackish, conidia branches 1-15 mm high, 10-15 μ broad. Columella, up to 75 μ in diameter. Primary sterigmata 20-100 μ long, each bearing from 3.8 secondary sterigmata-chains of conidia long, conidia spherical 3.5, 4-5 μ in diameter, brownish finely punctate.

This fungus has a wide range of temperature variation, 35-50 C, and is pathogenic. (Zopf.)



Sterigmatocystis sulphurea. A and B, Head of Conidia. C, Fertile branch. D and E, Primary and Secondary Sterigmata. F, Conidia. G, Columella.

Sterigmatocystis sulphurea Fres

Mycelium at first white, growing quite rapidly in glycerine agar, filling the Petri dish in six days, close, spreading, raising short fertile branches, 1-½ mm. in height, 15 μ in diameter bearing the conidia.

Columella broad, 40-60 μ, primary sterigmata about 9 μ long,

conidia in long chains, spherical, about 3μ, the whole head ochraceous in color, globular or very irregular.

Sterigmatocystis glauca Bain.

Mycelium white at first, spreading slowly lying close to the medium. Fertile hyphæ, erect, brownish to olive brown ¼-1 mm. in height, 4-6 μ. broad, bearing a columella about 15 μ in diameter. Primary sterigmata, 12-20 μ in length, secondary sterigmata, 3-5 in number, about 10μ long, conidia in short chains, greenish yellow 2.5, 4-5 μ.

Sterigmatocystis butyracea Bain.

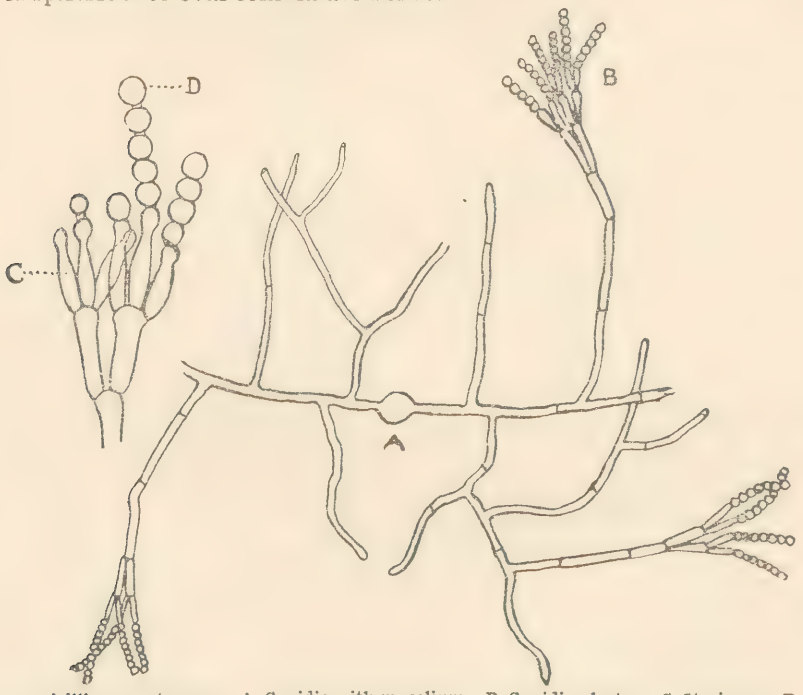
Mycelium thin, sparse, growing close to the medium, at first whitish, later pale yellowish. Fertile branches brown erect, unequal, bearing short conidial heads, Columella globose.

Primary sterigmata, 15-25 μ long, secondary about the same, conidia in short chains, light yellow, smooth, about 5 μ in diameter. The whole head light sulphur yellow in color.

Rarely found, twice only.

PENICILLIUM, Link.

Mycelium is richly developed in most of the forms, the fertile hyphæ are erect, septate, and branch into a series of compound branches, each of which bears simple sterigmata upon which chains of spherical or oval conidia are borne.



Penicillium crustaceum. A, Conidia with mycelium. B, Conidia cluster. C, Sterigma. D, Conidia

Penicillium crustaceum L. (P. glaucum Lk.).

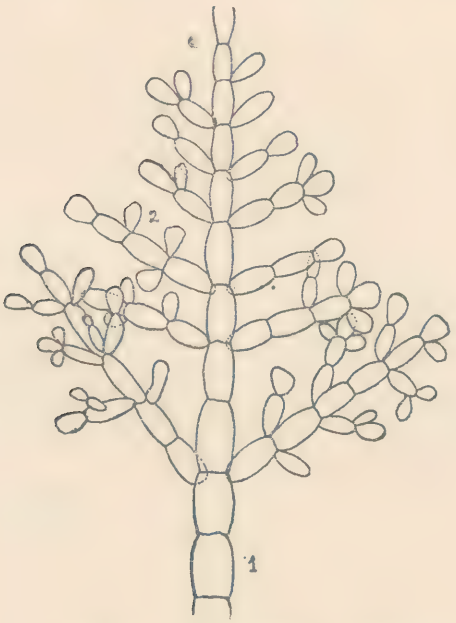
This species is readily recognized by its pale greenish color, its erect septate hyphæ, 1-2 mm. long, bearing a camel's hair pencil like cluster of greenish-spherical smooth conidia, averaging 2-3 μ not exceeding 4 μ in diameter.

This is the most common mould in the laboratory, producing fully 60% of all the contaminations, its growth is rapid, the odor is peculiar, its properties, especially in its formation of calcium oxalate crystals, interesting. Gelatine is not fluidified, litmus lactose agar is reddened markedly at first, later it is rendered blue. Probably oxalic acid and ammonia formations, respectively, produce the change. There is slight indol production and marked reduction of nitrates, no gas in fermentation broth. Milk is rendered at first acid, four days, with no marked visible changes, later it is rendered alkaline and thick. Apparently there is no production of peptone nor of albumose.

Penicillium digitatum (Fr.) Dacc.

This is a rarer plant, having been found but twice, once in the air, and once in some Delafield's Hematoxylin solution.

The growth is much less abundant, at first pale, grayish, becoming grayish brown to buff. The fertile hyphæ are quite



Botrytis. 1, Fertile Branch. 2, Conidia.

short, 1 mm., the conidia are generally oval, averaging 3 x 6 to 4 x 7 μ, smooth.

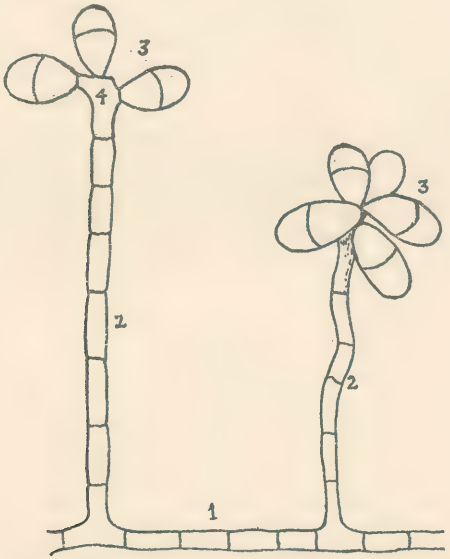
BOTRYTIS, Mich.

Sterile hyphæ, creeping close, immersed in the medium, fertile hyphæ, erect, soon branching tree like, the ends of the branches varying, in the species found, inflated, bearing single whitish conidia. Species undetermined.

CEPHALOTHECIUM, Corda.

Sterile hyphæ creeping, fertile erect, simple, septate, bearing at the inflated apex a small number of large oblong or pear-shaped, once septate hyaline conidia.

Cephalothecium rosaceum Corda.



Cephalothecium rosaceum. 1, Hyphæ. 2, Fertile Branch. 3, Conidia. 4, Columella.

Mycelium growing rapidly, at first white, soon pale rose colored, filling a plate in five days. Hyphæ more or less close, branching richly. Fertile branches, erect, simple, bearing 3-6 conidia, these are hyaline or slight rose pink, oblong ovoid, constricted at the center and septate, averaging 8 x 17 μ.

This has been common during the months of February, March, constituting 10-15% of the contaminations.

(2) DEMATIEÆ;

TORULA Pers.

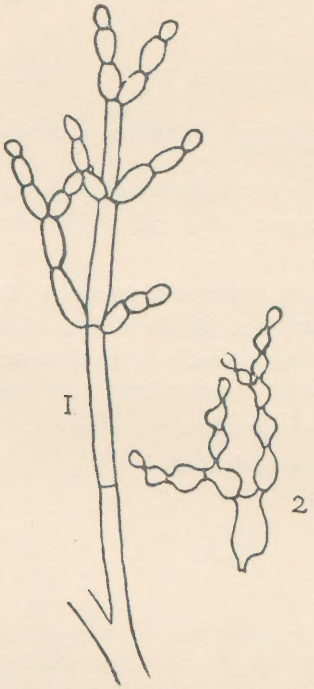
Sterile hyphæ, short simple, creeping immersed in medium, fer-

tile hyphæ erect, bearing short simple chains of brownish to purplish brown, globose, oblong or ovoid conidia. The whole plant brownish. Torula is like Oospora, but, is brown.

HORMODENDRON, Bon.

Sterile hyphæ brown, fertile erect or inclining, brown, septate, branched tree like, conidia borne in short chains at the ends of the branches, ovoid or globose.

Hormodendron cladosporioides (*Fres.*) Sacc.



Hormodendron cladosporioides. 1, Fruiting branch. 2, Conidia.

Mycelium spreading, olivaceous brown, conidia on the ends of the fertile tree like branches, oval to lemon-shaped, 3 x 4.5, 3 x 6 μ olivaceous, brown, simple, or sometimes once septate.

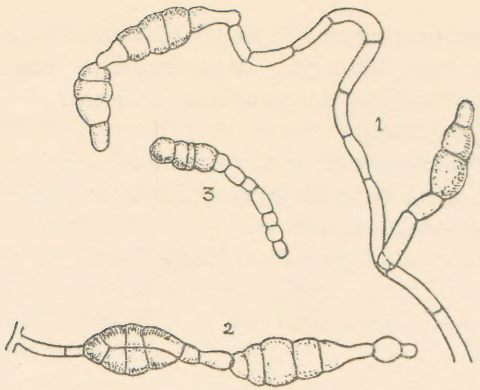
This is one of the commonest of the contaminating growths, occurring third in frequency.

ALTERNARIA, Nees.

Hyphæ, short spreading, fascicled, conidia peculiar, somewhat parsnip-shaped, in short chains.

Alternaria tenuis Nees.

Mycelium spreading, dark olivaceous brown, flat. Hyphæ parsnip-shaped, irregular, dark brown, divided into a number of



Alternaria tenuis. 1, Hyphae. 2, Conidia. 3, Conidum germinating.

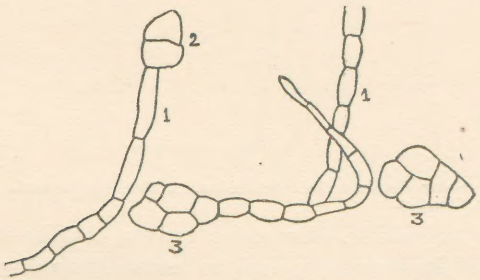
segments and borne in short chains of 3-4, variable in size, averaging 5-15 μ broad, 10-40 μ long, 3-4-5 times septate.

MACROSPORIUM, Fr.

Mycelium distinct, brownish fascicled, fertile branches intermingled, erect or creeping, simple or branched, erect or inclined or even horizontal, bearing a single large irregular globose conidium, which is septate in both longitudinal and transverse directions.

Nearly a hundred species are described.

Macrosporium commune Rab.



Macrosporium commune. 1, Hyphae. 2, 3, Conidia.

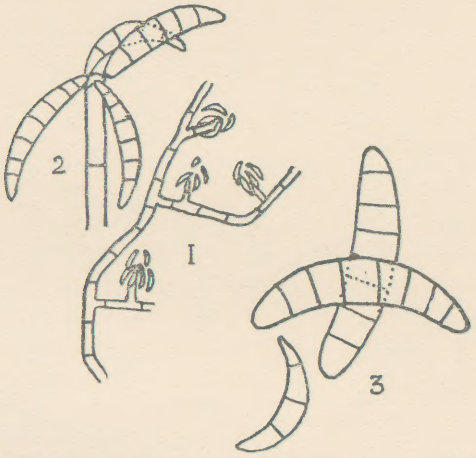
Olive brown, rapidly growing mycelium, 2 cm. in 4 days at room temperature; hyphæ, irregular, forming a loose fascicled mat, individual cells about 4-6 μ in diameter to some 70-90 in length. Conidia globose to ovoid, to oblong, 3-5 septate, dark brown, from 9-12 μ wide, 15-30 μ long.

This would seem to be rare species, at least for the months of January, February and March.

(4) TUBERCULARIÆÆ:

Fusarium roseolum (*Steph.*) *Sacc.*

The growth upon agar is comparatively rapid; 4 to 5 centimeters in from 5 to 6 days. At first it is of a fluffy whiteness, lying quite close to the medium and growing within it; here and there soon appear places of closer growth which assume a pinkish hue. These spots are about ½ centimeter in diameter and are formed by



Fusarium roseolum. 1, Fruiting branch. 2, Conidia cluster. 3, Conidia.

masses of conidia which are forming upon the fertile branches in groups of flat-lying clumps. They do not form distinct tubercle-like masses, but are flatter, technically termed, effused. The mycelium of the mould is fine and delicate, closely intertwining and forming close mats in the substance of the medium. The conidia are formed generally upon lateral branches in small groups. These soon coalesce in small masses and can be made out as individuals with great difficulty only. When just forming they are found to be made by the division of the cells of the fertile branches. When fully formed they are variable in shape and appearance; in general, slightly curved or fusiform, and divided into a number of segments; from 4 to 8.

They are delicate pink or hyaline and are 3 to 8 μ, wide, and 15 to 30 μ long.

231 W. 71st Street, N. Y., June, 1897.